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PRECISION

TEST EQUIPMENT

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ELECTRICAL
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LABORATORY**



1953

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SERIES E-200-C
Modern Multi-band
SIGNAL and MARKER
GENERATOR
(see page 4)

SERIES E-400
Wide Range H.F.
SWEEP SIGNAL
GENERATOR
(see page 2)

SERIES ES-500A
5 in. Hi-Sensitivity
Wide Range
OSCILLOSCOPE
(see page 3)

SERIES EV-10A
True Zero-Center
VTVM-MEGOHMMETER
with 7 in. Meter
(see page 4)

SERIES 612
Modern Free-point
TUBE and BATTERY
TESTER
(see page 10)

**THESE FIVE MATCHED "PRECISION" INSTRUMENTS
PROVIDE A COMPLETE MODERN BASIC LABORATORY
FOR TV-FM-AM AT ONLY MODERATE COST**

OTHER MATCHED COMBINATIONS

The instruments shown above, and other "Precision" equipments, are available in various enclosure styles...Panel Mounts, Portable, Counter Types, etc., designed to suit individual applications, field or shop. The illustration shows only one of the many possible "matched combinations" of diversified "Precision" Test Equipment. Each combination provides a selected and basic, modern, efficient laboratory at moderate cost.



SERIES TV
THE SUPER HIGH VOLTAGE
SAFETY TEST PROBE
for High D.C. Potential
Measurements up to
60,000 volts.
(see page 10)



*** SERIES EV-20 VTVM
and MULTI-RANGE TEST SET**

Complete with coaxial Circuit Isolating Test Probe, Shielded Ohmmeter Test Cable, Standard #107 Super-Flux Test Leads, Ohmmeter battery and full operating instructions.

In modern, black ripple finished cabinet. Size—10 1/2" x 5 1/4" x 5".
CODE: Parly

SERIES EV-20 VTVM and Multi-Range Test Set

**TRUE ZERO — CENTER ON ALL VTVM RANGES
WITH DIRECT PEAK READING HIGH FREQUENCY SCALES
Plus Complete Standard 1000 Ohms/Volt Functions
48 Ranges to 1200 Volts*, 2000 Megohms, 12 Amperes, +63 DB**

Series EV-20 is a compact, high sensitivity, laboratory-type, circuit-testing instrument, incorporating the most modern electrical and physical design. It provides unparalleled performance, accuracy and versatility required for AM-FM-TV and general electronic circuit analysis.

Functionally similar to the deluxe Series EV-10A VTVM, with extra large 7" meter. (described on Page 4) the Series EV-20 (with 4 1/2-inch meter) affords a highly efficient instrument at moderate cost.

RANGE SPECIFICATIONS

- * **SIX ALL-ZERO CENTER VTVM RANGES:**
10/3 Mega. Constant Input Resistance,
 ± 3 , ± 12 , ± 30 , ± 100 , ± 300 , ± 1000 volts.
*Direct Reading to ± 60 KV when used with
Series TV-4 High Voltage Test Probe de-
scribed on page 9.
- * **SIX SELF-CONTAINED RESISTANCE
RANGES:** 0-2000 - 500,000 ohms.
0-200-200-2000 Megohms.
- * **FOUR DIRECT PEAK READING HIGH FREQ.
VTVM RANGES:** 0-3-15-30-120 volts. (Requires
RF-10A High Freq. Vacuum Tube Probe, Net
Price \$14.40. No crystal rectifiers employed.)
- * **SIX AC-DC AND OUTPUT VOLTAGE
RANGES** at 1000 ohms per volt.
0-3-12-30-100-300-1200 volts.
- * **EIGHT D.C. CURRENT RANGES:**
0-300 microamps. 0-12-3-12-30-120-1200 MA.
0-12 Amperes.
- * **SIX DECIBEL RANGES** from -20 to +63DB.
Calibrated for 600 ohm, 1 mw., zero DB.
- * **ROTARY RANGE—FUNCTION SELECTORS**
eliminate frequent and inefficient shifting
of test leads.

IMPORTANT FEATURES

- * **VOLTAGE REGULATED — BRIDGE CIRCUIT**
- * **DIRECT READING, ALL ZERO-CENTER VTVM**
Indicates both Polarity and Magnitude with-
out switching or test lead reversal.
- * **SHIELDED CONNECTIONS** for D.C.—VTVM
and RF—VTVM. Facilitates maintenance and
non-interfering connection of both the Cir-
cuit Isolating Test Probe and optional H.F.
Vacuum Tube Probe Series RF-10A.
- * **DUAL - BALANCED ELECTRONIC BRIDGE
OHMMETER—MEGOHMMETER** uses two 1.5
volt cells easily replaced at rear of cabinet.
- * **ADDITIONAL 1000 OHMS/VOLT FUNCTIONS**
permit routine AC-DC voltage, DB and cur-
rent measurements free of power line.
- * **4 1/2" RECTANGULAR METER** — 200 micro-
amperes, $\pm 2\%$. D'Arsonval construction.
- * **1% Film type, Metallized and Wire-Wound
resistors** for all shunts and multipliers.
- * **Heavy gauge, round-cornered, beveled steel
case** with plastic handle. Eased, anodized,
aluminum panel.

This equipment is Approved (and/or Tested) by the CSA Approval Laboratories.



-PRECISION-TEST EQUIPMENT

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Series E-400

Wide Range Sweep Signal Generator

Narrow and Wide Band Sweep

Direct Reading from 2 to 480 Megacycles

DIRECTLY COVERS UHF AND VHF I.F. ALIGNMENT REQUIREMENTS



Incorporating selected and true high frequency components and circuits, Series E-400 has been Application Engineered specifically for modern F.M. and TV oscillographic alignment methods.

Stressing utmost simplicity of operation, flexibility and stability, Series E-400 affords an unparalleled standard of performance and value for the efficient TV-FM Service Lab.

FEATURES

- ★ **Direct Frequency Reading**—2 to 480 MC in 7 bands without skip. Harmonically calibrated from 240 to 480 MC. Directly covers frequency requirements for I.F. alignment of both UHF and VHF TV receivers.
- ★ **6 Position Rotary Band Switch** covers complete spectrum. No coil switching. Multiple oscillator B supply switch assures maximum frequency accuracy and stability.
- ★ **6 1/2" Etched Aluminum Tuning Dial**—Engine turned thick.
- ★ **1500 Point Vernier Scale** for close calibration and resetting.
- ★ **Engraved Transparent Lucite Frequency Indicator** affords readings free from parallax.
- ★ **Voltage Regulated Oscillators** free of power supply variations.
- ★ **The Basic Circuit and Tube Complement**—Uses 2 separate 6C4 high frequency beat oscillators plus a 6J6 screen-modulated high frequency oscillator. This positively eliminates generation of unwanted extraneous signals. Also employs a 6J5 mixer-buffer, a 6C4 multiple crystal oscillator and a 6J8 final marker-mixer amplifier. 6X5 full wave rectifier. VR-105 voltage regulator.
- ★ **Selected, True High Frequency Circuit Components.** Uses ceramic and air dielectric trimmers, coupling, by-pass and loading capacitors; rugged ceramic suspended, National Straight Line Frequency tuning condensers; modern miniature HF tubes; mica-filled low-loss sockets; shock mounted, compensated resistance modulators; multi-section copper-plate shielding; etc.
- ★ **Narrow and Wide Band Sweep**—0 to 1 MC and 0 to 15 MC.
- ★ **Dual Continuous R.F. Attenuators** triple shielded. Smooth, stepless, selective control from extra high output for single stage alignment to minimum levels for multi-stage adjustments.
- ★ **Wide Range Phasing Control** for Har. sweep or oscilloscope.
- ★ **Multiple Crystal Marker-Calibrator** built-in. Accommodates 4 rotary selected crystals. .01% accuracy 4.5 MC and 2 MC crystals furnished as standard equipment. Crystal signal separately attenuated for internal or external use.
- ★ **Crystal Calibrated and Control**—Each instrument calibrated against crystal standards. The 2 MC crystal permits crystal monitoring and calibration of external signal generators.
- ★ **Terminated RG/U Type Coaxial Output Cable** for efficient signal transmission with minimum standing wave effects.
- ★ **8 Element Double Section Balanced Line Filter** plus Thorough Multi-Section Copper Plate Shielding of instrument assures minimum leakage and radiation.
- ★ **Simultaneous A.M. and F.M. test facilities** for anti-A.M. check of F.M. second detector circuits. A.M. input jacks also permit use as a modulated H.F. A.M. Generator.
- ★ **External Deviation input facility** for sweep repetition frequency other than internal 60 cycle source.
- ★ **Fuse Protected** at panel external fuse post.
- ★ **Heavy Gauge, Etched-Anodized Aluminum Panel.**
- ★ **Fully Licensed** under W. E. A. T. & T. and Paton patents.

- ★ **Series E-400 (illustrated)**—In insulated portable copper-plated case. Size 10 1/2" x 12" x 6". Complete with test cables, 2 crystals and elaborate Technical Manual. Code: Nancy.
- ★ **E-400-FM**—Consists of E-400 on 12 1/4" x 19" steel panel for standard rack mount. Complete as above. Code: Nicee.

Series ES-500A

High Sensitivity, Wide Range, 5" Oscilloscope

Push-Pull Vertical and Horizontal Amplifiers

20 MV. per inch "V" Sensitivity

SELF-CONTAINED 1 VOLT PEAK TO PEAK CALIBRATOR

Series ES-500A affords the ultimate in performance, visibility and operational flexibility at moderate cost.

"Precision" engineers have incorporated every necessary feature which they found to be required to meet the needs of the rapidly advancing art of electronics.

Series ES-500A provides an unparalleled combination of high sensitivity, extended frequency range and other essential features specifically desired for experimental and commercial visual circuit analysis.



FEATURES

- ★ **High Sensitivity, Wide Range, Voltage Regulated, Push-Pull Vertical Amplifier**—20V. per inch deflection sensitivity. 10 cycles to 1 MC response. 2 megohm input resistance. Approx. 25 mfd. input capacity.
- ★ **Compensated Vertical Input Step Attenuator**—X1, X10, X100.
- ★ **Direct Peak to Peak Voltage Checks** thru use of internal, semi-square wave, regulated calibrator.
- ★ **Vertical Phase-Reversing Switch** permits inversion of all patterns at will. Non-frequency discriminating.
- ★ **Extended Range, Push-Pull Horizontal Amplifier**—350 MV (1.5 V) per inch high deflection sensitivity adequate for most all "H" drive purposes. 10 cycles to 1 MC response at full gain. 1/2 megohm, approx. 20 mfd. input.
- ★ **Linear Multi-Vibrator Sweep Circuit**—10 cycles to 30 KC plus internal line or external sweep.
- ★ **Amplitude Controlled, Four Way Sync. Selection**—Internal Positive, Internal Negative, External and Line.
- ★ **"T" Axis Modulation** input facility for blanking, timing, etc.
- ★ **Internal, Phasable 60 cycle Beam Blanking** for elimination of alignment trouble; clean display of sync. pulses, etc.
- ★ **Sweep Phasing Control** for sinusoidal line sweep usage. Wide angle bridge circuit.
- ★ **Direct H and V Deflection Plate Connections** and Audio Monitoring phone jacks at rear. All four plates accessible.
- ★ **High Intensity CR Patterns** through use of adequate high voltage power supply with separate 2X2 rectifier.
- ★ **The Circuit and Tube Complement**—6C4 Vertical input cathode follower. 6C6 first "V" amplifier. 6C4 "V" phase inverter. Push-Pull 6J6's vertical CR driver. 7N7 first "H" amplifier and phase inverter. Push-Pull 6AU6's horizontal CR driver. 7N7 Multi-vibrator internal linear sweep oscillator. 5Y3 low voltage rectifier. 2X2 high potential rectifier. VR-105 voltage regulator. 5CP1/A CR Tube.
- ★ **7 Four-Way Lab-Type Input Terminals**—Take banana plugs, phone tips, bare wire or spade lugs.
- ★ **Light Shield and Mask** removable and rotatable.
- ★ **Extra Heavy-Duty Construction** and components to assure "Precision"-engineered performance.
- ★ **Heavy Gauge, Etched-Anodized, No-Glare, Aluminum Panel.**
- ★ **Fully Licensed** under Western Electric Co. patents.
- ★ **Series ES-500A (illustrated)**—In insulated, black-rippled, heavy gauge steel case. Size 8 1/4" x 14 1/2" x 18". Complete with light shield, calibrating mask and comprehensive instruction manual. Code: Quick.

Series SP-5—Oscilloscope Test Probe Set

FOR TV SIGNAL TRACING, ALIGNMENT, TROUBLE SHOOTING AND WAVEFORM ANALYSIS

- ★ **Specifically engineered** for use with PRECISION Cathode Ray Oscillographs, Series ES-500 and ES-500A.
- ★ **Set consists of shielded Master Cable** and four different, detachable probe heads in custom-made vinyl carrying case.
 1. HIGH IMPEDANCE—LOW CAPACITY PROBE
 2. CRYSTAL—DEMODULATOR PROBE
 3. RESISTIVE—ISOLATING PROBE
 4. SHIELDED—DIRECT PROBE

This equipment is Approved (and/or Tested) by the CSA Approval Laboratories.



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STANDARD OF ACCURACY



- ★ EV-10A (MOP) (Illustrated) In black ripple finished, heavy gauge steel case. Size 10 1/2" x 12 1/2" x 6". Complete with tubes, battery, and test probes. Code: Panel.
- ★ EV-10A (P) In hardened portable case with tool compartment. Size 12" x 13" x 6". Code: Frame.
- ★ EV-10A (PM) Consists of Series EV-10A on steel panel. Size 12 1/2" x 10", for standard rack mount. Code: Panel.

★ **SERIES RF-10A VACUUM TUBE R.F. PROBE**
Accessory for Series EV-10A & EV-20; affords direct high frequency peak voltage measurements. Connects directly to VTVM panel. Employs 9001 miniature tube. Code: Probe.



PRECISION SERIES EV-10A VTVM—Megohmmeter

TRUE ZERO-CENTER VTVM WITH 7" FULL-VIEW METER
FOUR DIRECT PEAK READING HIGH FREQUENCY SCALES

Plus standard 1000 Ohms per Volt Functions.
Ranges to 6000 Volts, 2000 Megohms, 12 Amperes, +77 DB.

All prices are subject to change without notice

A WIDE-RANGE, TRUE ZERO-CENTER ELECTRONIC INSTRUMENT, stressing the utmost in performance, accuracy, and ease of manipulation. The Series EV-10A permits rapid check of voltage, current, and resistance conditions encountered in modern A.M., F.M., and TV Networks, without materially disturbing the performance of circuits under analysis.

RANGE SPECIFICATIONS

- ★ Eight All Zero-Center VTVM Ranges: ± 12 , ± 60 , ± 120 , ± 300 , ± 600 , ± 1200 , ± 6000 volts D.C. self-contained.
- ★ High Input Resistance—15% mega, constant to 600 volts, 25% megohms at 1200 volts, 133% megohms at 6000 volts.
- ★ 4 Direct Reading High Freq. Ranges: 0.3-12-60-120 peak volts. (Requires Series RF-10A High Frequency Vacuum Tube Test Probe described and illustrated at left.)
- ★ Extra-High Voltage Ranges to ± 80 KV, when employed with Series TV-4 High Voltage Probe described on page 6.
- ★ Six Ohmmeter-Megohmmeter Ranges: 0-2000-200,000 ohms, 0-3-20-200-2000 megohms.
- ★ Eight Extra A.C.-D.C. Output Voltage ranges at 1000 ohms per volt. 0-3-12-60-120-300-600-1200-6000 V.
- ★ Eight D.C. Current Ranges: 0-300 microamperes, 0-1.2-3-30-120-600-1200 MA, 0-12 amperes.
- ★ Eight DB Ranges from -70 to +77DB, Calibrated for 1MW, 600 ohms zero DB.

IMPORTANT FEATURES

- ★ Voltage Regulated-Bridge Type Circuit affords practical freedom from tube and line voltage variations.
- ★ True Zero-Center VTVM—Indicates both magnitude and polarity without reversal of test leads on all ranges.
- ★ Rotary Range and Function Selectors minimize sliding of test leads.
- ★ Recessed 6000 volt Safety Jacks.
- ★ Shielded Coax Test-Cable Connectors permit both D.C. and R.F. probes to be connected simultaneously.
- ★ Duo-Balanced Electronic-Bridge Ohmmeter—Megohmmeter. Uses 3 self-contained, standard 1.5 volt batteries.
- ★ Special 1000 Ohms/Volt Functions permit routine A.C.-D.C. circuit tests free of need for power line connection.
- ★ Extra-large 7" Rectangular Meter, 300 microamperes, $\pm 2\%$ sensitivity.
- ★ Highest Quality Components employed throughout—1% wire, film and matched resistors • Silverplated switch contacts • Leakage-resistant, plastic insulated hook-up wire • Etched-anodized aluminum panel • Heavy duty line cord.

Precision Series E-200-C Signal Generator

A Modern Multi-Band Signal and Marker Generator for A.M., F.M., and Television Alignment.

Featuring "Servicing by Signal Substitution." The Dynamic Speed Approach to Receiver Alignment and Adjustment Problems.

SPECIFICATIONS

- ★ FREQUENCY COVERAGE: 88 KC. to 120 MC., 30 MC. on fundamental. 6 1/2" Dial direct reading in 8 bands to 120 MC. No charts required.
- ★ ACCURACY—CONSTANCY OF CALIBRATION: 1% accuracy on all bands. Uses "PRECISION" developed "UNIT-OSCILLATOR" turret construction.
- ★ 0-1000 POINT VERNIER SCALE, direct reading in one part in 1000.
- ★ THE CIRCUIT—single-ended 6S17 in stable E.C.C. circuit—modulated by a 6CS sine-wave audio oscillator. 373 Full wave rectifier.
- ★ 400 CYCLE SINE-WAVE AUDIO OSCILLATOR—over 50 volts output.
- ★ DUAL R.F. ATTENUATORS—smooth, stepless control of R.F. signal.
- ★ SHIELDING—Compartment shielding of vital components—Power transformer electrostatically shielded—A.C. line is R.F. filtered.
- ★ SHIELDED COAXIAL OUTPUT CABLE and (LO-HI) cable connections.
- ★ FOUR TYPES OF SIGNALS—"Unmod. R.F.", "400 cycle Mod. R.F.", "EXTERNALLY Mod. R.F.", "400 cycle Audio Output."
- ★ DIRECT READING VARIABLE MODULATION—0-100%—triples signal utility on against obsolete fixed or stepped modulation of only 50 or 45%.
- ★ BUILT-IN A.V.C.-A.G.C. SUBSTITUTION—Overcomes alignment troubles arising from varying receiver A.V.C. and A.G.C. voltages.
- ★ HAND CALIBRATED—Each instrument is INDIVIDUALLY calibrated.
- ★ FULLY LICENSED under patents of A. T. & T. and W. E. Co's.
- ★ Not only an efficient Signal Generator for purposes of alignment but also specifically designed for "Servicing by Signal Substitution."
- ★ IDEAL MARKING GENERATOR—Exceptional stability and high accuracy renders Series E-200-C an excellent variable frequency Marker Generator for use with the Series E-400 or similar high quality Sweep Signal Generator.



★ **Series E-200-C**—(Illustrated) In black ripple finished, portable steel case. Size 10 1/2" x 12 1/2" x 6". Complete with tubes, output cable and FREE copy of "Servicing by Signal Substitution." Code: Trade.

★ **Series E-200-C-FM**—Consists of E-200-C on steel panel size 12 1/2" x 12", for standard rack mount. Code: Trade.



"SERVICING BY SIGNAL SUBSTITUTION" The modern ECONOMICAL solution to your daily service problems. Nothing simpler is there, no expensive equipment to purchase. A systematic series of DYNAMIC SIGNAL ANALYSIS based entirely on fundamentals. Fully described in a bound illustrated text "Servicing by Signal Substitution." This highly valuable book is supplied with Series E-200-C at no charge. Additional copies available at your Precision distributor or directly from factory at 48¢ per copy.

This equipment is Approved (and/or Tested) by the CSA Approval Laboratories.



-PRECISION-TEST EQUIPMENT

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ELECTRONAMIC (Reg. U. S. Patent Office)



Series 10-15 *Electronamic Test Master* Deluxe Tube and Battery Merchandiser with Large 9" Meter

The All-Inclusive, Positive Vacuum Tube Performance Test
that is not limited to Mutual Conductance Alone.

(Technical details on pages 6 and 7)

- ★ Incorporates the Electronamic tube performance and battery testing circuit, described for Series 10-14 on page 8.
- ★ Designed particularly for equipment-conscious, progressive radio service-amen organizations, and tube-selling sections of department stores.
- ★ PROMOTE CUSTOMER CONFIDENCE and tube sales via this impressive "Precision" Tube Merchandiser.
- ★ DIRECT READING non-confusing tube performance indications in large, easy reading terms of Replace-Weak-Good.

- ★ ILLUMINATED by custom-built, highly polished, plated reflector.
- ★ 10-15 Tube and Battery Merchandiser (illustrated), Heavy gauge steel cabinet in line, dull black ripple, with chrome trim and reflector. Size 24" high, 17 1/2" wide, base depth 10" tapering to 4" at top. Code: Cable.
- ★ 10-15PM—On heavy gauge steel panel with dust cover. Panel 22 3/4" x 19" for standard rack mount. Fine, dull black ripple finish. Code: Gavel.

Series CR-30 CATHODE RAY TUBE TESTER TESTS ALL TV PICTURE TUBES (Magnetic and Electrostatic) OSCILLOSCOPE AND INDUSTRIAL CATHODE RAY TYPES

SERIES CR-30 IS A COMPLETE, SELF-CONTAINED INSTRUMENT particularly engineered for the very special needs of reliable, rapid and economical cathode ray tube testing, in the field, shop or laboratory.

Series CR-30 is indispensable to the efficient TV Service-Installation Technician, TV Service Laboratory and wherever one is called upon to answer the performance question, "IS IT THE CATHODE RAY TUBE OR IS IT THE CHASSIS?"

Series CR-30 incorporates a BEAM CURRENT TEST CIRCUIT which checks overall electron-gun performance for Proportionate Picture Brightness. Additional direct testing facilities are provided for positive check of accelerating anodes and deflection plate elements.

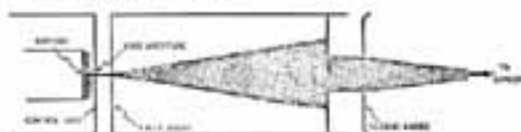
The Precision CR-30 should not be confused with mere adapters connecting to ordinary receiving tube testers which were never designed to meet the very specialized needs of CR tube checking. Similarly, it is not to be confused with neon lamp units or similar devices of limited technical merit and which do not check all CR tubes or all tube elements.



GENERAL AND TECHNICAL SPECIFICATIONS

- ★ Tests All Modern Cathode Ray Tubes—Magnetic and Electrostatic picture tubes, "Econo-Tubes" and Industrial Types without removal from carton or TV chassis.
- ★ Tests All CR Tube Elements—Not just a limited few.
- ★ Absolute Free-Point 14 Lever Element Selection System for Short-Check, Leakage Testing and Quality Tests. Independent of multiple beam pin and floating element terminations. Affords maximum anti-obsolescence insurance.
- ★ Beam Current Test Circuit checks all CR Tubes and Electron-gun in operation. It is the Electron Beam (and NOT total cathode emission) which traces the pictures or patterns on the face of the CR tube.

Total cathode emission can be very high and yet Beam Current (and picture brightness) unacceptably low. The CR-30 will reject such tubes because it is a Beam Current tester. Conversely, total cathode emission can be low and yet Beam Current (and picture brightness) perfectly acceptable. The CR-30 will properly pass such tubes because it is a Beam Current tester. The significance of the above tests is the fact that Beam Current (and picture brightness) is primarily associated with the condition of the center of the cathode surface and not the overall cathode area. (See illustration below.)



- ★ Voltage Regulated, Bridge Type VTVM provides the heart of the super-sensitive, tube quality test circuit. Such high sensitivity is also required for positive check of very low current anodes and deflection plates.
- ★ Multiple Test Sensitivities plus selectable element test potentials permit proper accommodation of all CR tube types, Magnetic and Electrostatic.
- ★ Micro-Line Voltage Adjustment, which is Meter-monitored at filament supply, provides repeated close control of operating voltages.
- ★ Accuracy of test circuits closely maintained by use of factory adjusted internal calibrating controls; plastic insulated, telephone type cabled wiring; highest quality, conservatively rated components.
- ★ Built-in, High Speed, Roller Tube Chert.
- ★ Test Circuits Transformer isolated from power line.
- ★ 4 1/4" Full Vision Meter with special scale-plate expressly designed for CR tube testing requirements.
- ★ Heavy Gauge Aluminum Panel, etched and woodized.
- ★ PLUS many other special "PRECISION" details and features.

SERIES CR-30—In hardwood, tapered portable case, with hinged removable cover. Carry-Along Tool and Test Cable Compartment. Overall Dimensions 17 1/4" x 13 3/4" x 6 1/4". Complete with standard picture tube cable, universal CR Tube Test Cable and detailed Instruction Manual. Code: Daisy.

This equipment is Approved (and/or Tested) by the CSA Approval Laboratories.

PRECISION Electronamic TUBE TESTER

PRINCIPLES OF ELECTRONAMIC TUBE TESTING

**The All-inclusive, Single-operation, Positive Vacuum-Tube Performance Test
that is not limited to Mutual Conductance Alone**

☆ A most perplexing issue confronting the Radio-TV service technician is the choice of tube testing equipment that will solve his tube test problems with **greatest possible accuracy and reliability**. With this thought foremost in mind, **PRECISION** engineers have devoted much time in extensive vacuum tube testing research and development.

All varieties of tests were conducted upon thousands of tubes, at our own fully equipped laboratories and at the plants of leading tube manufacturers. From this, a vital point stood out above all others which dictated that "the resultant tube tester design cannot be based upon just one selected characteristic, such as just mutual conductance alone."

☆ A tube test based upon just any one characteristic does not fully vouchsafe the over-all performance capabilities of an amplifying tube.

When a vacuum tube is "receiver tested", the electronic circuits **DEMAND PERFORMANCE** predicated upon the simultaneous presence and interaction of a multiplicity of tube characteristics including the following:

- Electron Emission
- Amplification Factor
- Plate Resistance
- Mutual Conductance (Transconductance)
- Plate Current
- Power Output, etc.

☆ To perform a whole series of such individual tests, in order to evaluate the overall merit of a tube, involves a collection of laboratory equipment hardly available to the general user of vacuum tubes. In addition, these characteristics are very closely knit to operating parameters. To the electronically trained mind, this means that the predictable characteristic values are dependent upon the great variety of voltage, current and load conditions to which the tube, under consideration, may be subjected. This further means that for ANY GIVEN TUBE TYPE, there is not just one value of mutual conductance or power output, etc. characteristic of that tube.

For this very reason tube characteristic manuals list **CURVES** (graphs) of operation to assist the design engineer in selecting tubes and circuit parameters which he desires to employ in the particular receiver or other electronic apparatus being developed.

The printed tabular data listed in tube manufacturers' manuals is not to be considered as fixed and inflexible ratings. Rather, such examples of operating conditions are given merely as guiding information. The tubes can be and are used under any suitable conditions within their maximum ratings. The **curves** provide the information to determine the proper operating points which will yield a required characteristic.

☆ One other aspect of the tube engineering problem is the question of rejection limits for any particular characteristic. This actually is a double-barrelled topic. New tube production is concerned with "Production Tolerance Limits." The electronic design engineer, and of course the apparatus which uses the tubes, are further interested in "Life Test End Limits."

Electronic apparatus, using vacuum tubes, must not only perform well with tubes which are within "Production Tolerance Limits," but should be able to perform until the tube has reached its "Life Test End Limit."

Detailed specifications of such "limits" are not generally available to the field and of course, specific numerical characteristics tests (such as micromhos) are inconclusive unless compared to a detailed table of limits paralleling actual test parameters or actual testing conditions.

Moreover, numerical characteristics readings (as micromhos) are not fully meaningful unless the tester duplicates the exact voltages and loads under which the particular tube in question is actually operating in the specific circuit from which it has been removed. It would furthermore require reference to the tube's plate family and transfer characteristic curves in order to determine what the numerical characteristic **SHOULD** be under the particular conditions in which the receiver is using this tube.

☆ Therefore, since the numerical value (such as micromhos) of a tube characteristic varies so widely with the applied element potentials, it is necessary that **TRUE** vacuum tube characteristics measuring instruments provide:

1. Appropriate means for metering and reading each and every applied element potential.
2. Appropriate means for metering and reading each tube element current.

3. Suitable devices for adjustment and control of every element potential to duplicate operating conditions or to set up the specific operating point being investigated.

☆ It is obviously impractical to construct such a device, for general tube testing, as would permit the operator to do this; not only from the viewpoint of simplicity of operation, but also in consideration of the extremely high cost and physical size.

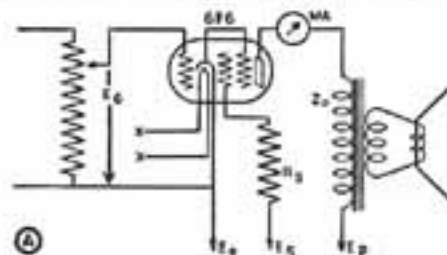
Accordingly, such equipment (for actual numerical characteristics investigations) is usually only found in research and production laboratories, which are the only places wherein such elaborate equipment might ever be required.

Needless to say, it would also not be practical for a tube tester's chart data to offer a multiplicity of alternative test settings for each and every tube.

☆ It has therefore been the constant purpose of **PRECISION** engineers to develop a tube tester circuit which would best meet the realistic needs of the electronic maintenance and Radio-TV service professions; to develop a basic test circuit affording the ultimate in correlation between test results and actual "in application" performance.

In the course of such investigations, it becomes conclusively apparent, that regardless of amplifier tube type number or variety of circuit applications, one phenomenon constantly manifests itself: the tube output (voltage or power) is the result of a plate current caused by an applied control grid voltage, which current must be adequate even at full peak operating conditions. This being a basic concept of amplifier tube operation (involving all operating characteristics), it led to the now famous, time-proven and tried, **PRECISION Electronamic** tube tester. (Reg'd U. S. Patent Office)

☆ In offering the **Electronamic** tube tester, to the discriminating purchaser, **PRECISION** does so with a "performance checked" background. Such "performance" tests, heavily emphasized during World War II, were



based upon the primary purpose of the instrument—TO FIND BAD TUBES!

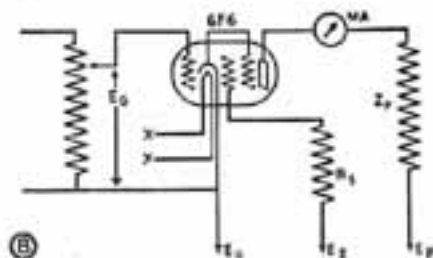
☆ To familiarize ourselves with the principles of this **PRECISION** innovation, let us briefly observe the operation of a simple pentode such as the 6F8, in a standard power amplifier stage, shown in **Diagram A**, with the addition of a current indicating meter in the plate circuit.

The primary purpose of this tube is to deliver electrical output to the speaker through plate load Z_p , in the following manner: with filament and plate supply operating and with zero signal applied to the input circuit, the plate milliammeter "MA" will indicate a steady current flow dependent upon cathode emissive power and the potentials of the interspaced elements. This zero signal meter reading is an indication of the tube's plate conductance. By applying an audio signal, E_g , to the input grid, **THE PLATE CURRENT THROUGH Z_p MUST VARY IN ACCORD WITH THE CHANGES IN GRID VOLTAGE.** This is dependent upon the mutual conductance, plate resistance, amplification factor, load resistance, etc. The greater the grid voltage swing, the greater should be the plate current excursions, and accordingly, the louder the sound from the speaker.

Let us now assume that a high order of peak grid signal voltage is applied, that is in keeping with the tube operating conditions, but severe distortion is nevertheless produced at the speaker, even though all circuit components, aside from the tube, are normal. This condition coincides with low peak plate current readings, and is usually caused by poor cathode structure and/or high plate resistance. In other words, an insufficient quantity of electrons is available to the plate circuit to handle peak power requirements.

Now let us suppose that with a normal signal applied to the input circuit, insufficient or no volume is obtained from the speaker, again assuming all circuit components, aside from the tube, are normal. This condition would indicate that the magnitude of plate current variations versus applied grid signal are not in keeping with the tube specifications and circuit requirements. This can be caused by a multiplicity of internal tube conditions, including reduced amplification factor, low mutual conductance, open, misplaced or shorted screen, control grid, suppressor, or plate, even though the tube's cathode structure may be absolutely normal.

In the case of resistance-coupled amplifiers, the change in plate current produces a change in voltage drop across the plate load resistor. This is then passed on through suitable coupling means to the succeeding stage.



☆ It can therefore again be readily seen that the overall **PERFORMANCE** Merit of a tube is absolutely dependent on the ability of output plate current to respond to the applied grid voltage, over the full range of possible operating conditions, which involves More than just Mutual Conductance.

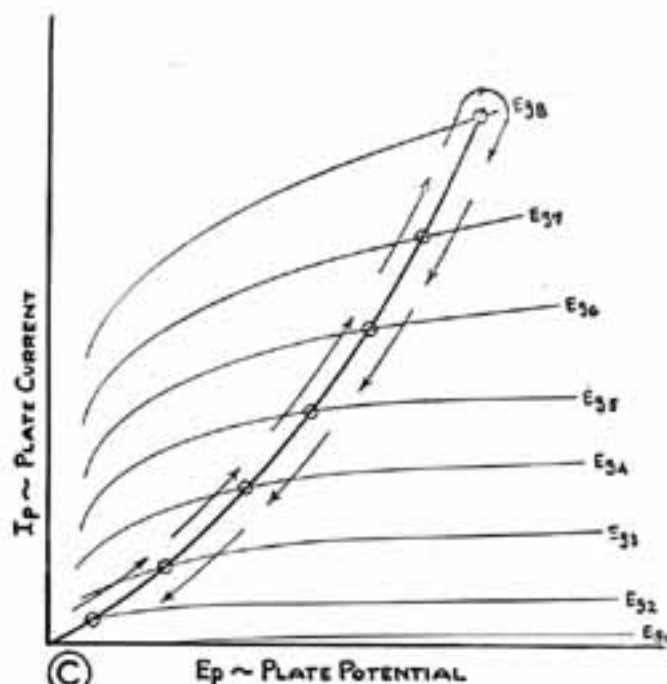
In **Diagram B** is shown the **PRECISION Electronic** circuit set up to check the same type 6F8. Note that individual plate, screen and grid voltages and loads are applied to the respective elements of the tube under test and it is thereby being **Electronically** tested as a pentode. **PLATE SUPPLY VOLTAGES FROM 50 TO AS HIGH AS 300 VOLTS ARE APPLIED TO THE TUBES UNDER TEST DEPENDING ON THE INDIVIDUAL TUBE'S REQUIREMENTS.**

Appropriate treatment is accorded all amplifier tubes depending whether they are triodes, tetrodes, etc. Multi-purpose tubes are treated and tested as two or more completely independent tubes, **WITHOUT REMOVING THE TUBE FROM THE TEST SOCKET.** All plate, screen, grid and filament test voltages and respective loads are factory calibrated (per the roller chart) to assure the high tube performance correlation for which the **Electronic** tube testers are known to the field, both civilian and the military—a performance check based upon the **peak service** for which the tube was designed rather than just an arbitrarily chosen low or midpoint.

☆ As previously outlined, the overall quality or performance merit of a tube is dependent on how well control grid voltage "controls" plate current over a complete range of tube application.

For this reason, the **PRECISION Electronic** circuit places the **TUBE MERIT METER** in the plate or output section only of the tubes under test. Accordingly, the resultant quality or performance figure of merit involves a whole series of meaningful operational factors, not just one inconclusive characteristic, and will reject all tubes which do not come up to the same standards from which the tube chart data is prepared.

☆ Much of the success of the **Electronic** tube tester is attributable to the **ELECTRO-DYNAMIC SWEEP** nature of its circuit operation. Through application of appropriately phased individual element potentials, the tube under test is dynamically swept over a **Path of Operation**, on a sinusoidal time base, encompassing a wide range of plate family characteristics curves. In brief, the tube under test is made to **perform** on a basis which involves its ability to operate at a multiplicity of potential peak



conditions rather than at just one arbitrarily chosen point.

Reference to **Diagram C** graphically and directly illustrates this **Electronic** picture. It is this encompassing **Path of Operation**, involving More than just Mutual Conductance, which is automatically integrated by the meter as the resultant figure of merit in the direct and non-confusing terms of **REPLACE-WEAK-GOOD.**

☆ The very nature of the **Electronic** circuit necessitates and ensures utmost instrument flexibility, to permit positive location and selection of all tube elements. This is accomplished in the Series "10-00" **MASTER TUBE TESTERS** via design and use of a new **LEVER TYPE** master element selector system in combination with a multiple push-button short-check unit, plus specially engineered rotary, load and element potential selectors.

☆ Aside from the development of the complete **Electronic** circuit, full consideration was given to the design of a Hot Cathode Leakage test, inter-element Short Check, instantaneous Filament Continuity Test and Audible Noise Test, affording maximum reliability and accurate neon lamp indications to show up physical and mechanical tube defects such as cathode to filament leakage, shorted, loose or open elements, open filaments, etc. **THE CATHODE LEAKAGE CIRCUIT SENSITIVITY IS ADJUSTED TO COMPLY WITH THE APPROVED LEAKAGE SPECIFICATIONS OF LEADING TUBE MANUFACTURERS.** Additional independent circuit facilities appropriately accommodate diodes, rectifiers, tuning eyes, gas rectifiers, thyatrons, etc.

☆ Modern methods of instrument construction, telephone cabled wiring and highest quality of materials afford maximum ruggedness for long-lasting satisfaction. **INDIVIDUAL DUAL CALIBRATION** against laboratory standards, insures maximum accuracy, and controlled, uniform **PRECISION** performance.

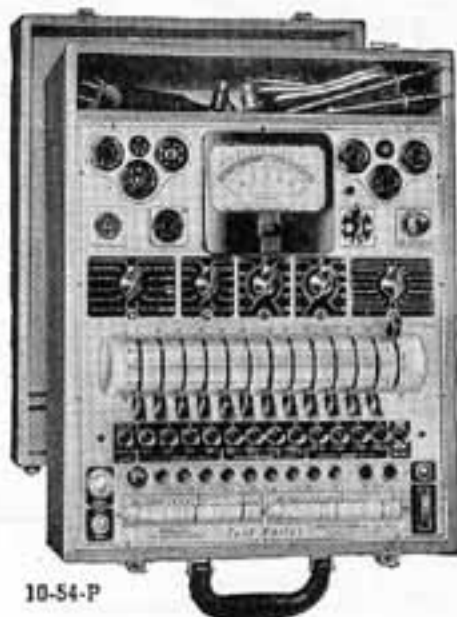


-PRECISION- TEST EQUIPMENT

STANDARD OF ACCURACY

All prices are subject to change without notice

ELECTRONAMIC (Reg. U. S. Patent Office)



10-54-P

CIRCUIT TESTING FEATURES

A complete, wide-range, high speed, push-button operated, super-sensitive test set
Completely Self-contained

- ★ Six D.C. Voltage Ranges: 10,000 ohms per volt.
- ★ Six A.C. Voltage Ranges: 1000 ohms per volt.
- ★ Six Output Ranges at 1000 ohms per volt. 0-6-12-60-300-1200-6000 volts.
- ★ Ranges to 30,000 Volts D.C. when used with Series TV-2 super high voltage test probe. Not included with 10-54. See page 9.
- ★ Seven D.C. Current Ranges: 0-60-120 microamperes, 0-12-15-120-1200 MA. and 0-12 amperes.
- ★ Four Self-Contained Resistance Ranges: 0-6000-600,000 ohms; 0-6-60 megohms.
- ★ Six Decibel Ranges from -20 to +70 DB.
- ★ Automatic Push-Button range selection.
- ★ 1% Wire, Film and Metallized Resistors.

Series 10-54 Electronamic Test Master

Combination Tube Performance Tester, Battery Tester, and 35 Range, Push-Button Operated, Supersensitive, A.C.-D.C. Set Tester.

Ranges to 6000 Volts, 60 Microamps, 12 amps, +70 DB, 60 Meg.
20,000 Ohms per Volt D.C.—1000 Ohms per Volt A.C.

The All-Inclusive, Positive Vacuum Tube Performance Test that is not limited to Mutual Conductance Alone.
(Technical details on pages 6 and 7)

Series 10-54 affords to the discriminating instrument purchaser, THE COMPLETE PORTABLE SERVICE LABORATORY; engineered to meet the expanding needs of modern radio electronics. Provides every necessary facility for high speed, reliable tube and circuit testing associated with Industrial Electronics, Communications, Radio (A.M., F.M.), Television, Laboratory, etc. . . .

TUBE AND BATTERY TESTING FEATURES

- ★ A TUBE "PERFORMANCE" TESTER: "Precision" ELECTRONAMIC circuit, effectively tests all tubes over a complete "Path of Operation" not just at one arbitrary operating point or for just one inconclusive characteristic.
- ★ TESTS ALL MODERN TUBE TYPES: Novel 9 pin, 7 pin Aogen, dual copped H.F. tubes, Single-Ended TV, and F.M. amplifiers, low power transmitting tubes, sub-miniature types, etc. . . . including direct facilities up to twelve element prong!
- ★ ABSOLUTE FREE-POINT LEVER ELEMENT SELECTION: Highest possible, practical order of obsolescence insurance. Locates every tube element regardless of base position.
- ★ ABSOLUTE FREE-POINT, INTER-ELEMENT SHORT-CHECK and Visible Filament Continuity System.
- ★ DUAL SHORT-CHECK SENSITIVITY: Permits selection of tubes for special applications.
- ★ INDIVIDUAL TUBE SECTION TESTS of multi-section tubes.
- ★ A.M. and F.M. CATHODE RAY TUNING INDICATORS directly tested.
- ★ FILAMENT VOLTAGES $\frac{1}{4}$ to 117 V.
- ★ BALLAST UNIT TESTS.
- ★ NOISE and CONDENSER TESTS.
- ★ MICRO-LINE ADJUSTMENT via continuously variable line voltage control.
- ★ PILOT AND SIGNAL LIGHT TESTS.
- ★ ACCURACY of test circuits closely maintained by use of individual, internal calibrating controls.
- ★ HIGH SPEED ROLLER TUBE-CHART.
- ★ EXTRACTOR FUSE POST.
- ★ Test circuits completely transformer-isolated from power line.
- ★ TELEPHONE-TYPE CABLED, plastic-insulated, moisture-resistant wire.
- ★ $\frac{1}{4}$ " FULL VISION METER: 50 microamperes, 2% accuracy.
- ★ TESTS RADIO A, B and C DRY BATTERIES via a "PRECISION" engineered circuit which performance checks each battery under actual load conditions. Battery quality read directly on a 3-color scale.

10-54-P (Illustrated above)
Hardwood, tapered, portable case, 13 $\frac{1}{4}$ " x 17 $\frac{1}{4}$ " x 6 $\frac{1}{2}$ ". With ohmmeter batteries and high voltage test leads.
Code: Habit.

10-54-C (see 10-12-C illustration and description below) In modern, attractively finished, steel counter cabinet.
Code: Handy.

10-54-PM (see 10-12-PM illustration and description below) In standard Panel Mount, with dust cover.
Code: Harem.

Series 10-12 Electronamic Tube Master

Truly Free-Point Tube and Battery Performance Tester.

The All-Inclusive, Positive Vacuum Tube Performance Test that is not limited to Mutual Conductance Alone.
(Technical details on pages 6 and 7)

The 10-00 Series of TUBE and TEST MASTERS represent the culmination of many years' development of tube testing equipment to meet the exacting needs of the rapidly advancing field of electronics.

Incorporating the "PRECISION" ELECTRONAMIC Tube Performance Testing Circuit, plus an advanced, "PRECISION" developed, multiple element, master lever selector system, it truly can be said that the MASTER 10-00 Series offers, to the discriminating equipment purchaser, the highest possible practical order of test results and anti-obsolescence insurance.

TUBE AND BATTERY TESTING FEATURES

The Series 10-12 Electronamic Tube Master incorporates the same time-proven circuit and exacting performance details described for the Series 10-54, above, under the heading: "Tube and Battery Testing Features."

★ **10-12-P** (see 10-54-P illustration and description above)
In hardwood, tapered, portable case with tool compartment. Code: Faith.

★ **10-12-C** (Illustrated at right)
In modern, chrome-trimmed, round edged counter cabinet. Fine dull black ripple finish on heavy gauge steel. Size 17" x 17 $\frac{1}{4}$ " x 7 $\frac{1}{2}$ " sloping to 3" at front. Code: Faith.

★ **10-12-PM** (Illustrated at right)
Consists of 10-12 chassis, mounted onto standard size steel panel, 17 $\frac{1}{2}$ " x 19" with dust cover. Fine, dull black ripple finish. Code: Fever.



10-12-C



10-12-PM

This equipment is Approved (and/or Tested) by the CSA Approval Laboratories.



-PRECISION-TEST EQUIPMENT

STANDARD OF ACCURACY

All prices are subject to change without notice



858-P

Series 858 High Sensitivity *Multi-Master*

HIGH SPEED, A.C.-D.C. MULTI-RANGE TEST SET

54 Ranges to

6,000 Volts, 60 Microamperes, 12 Amps., 600 Megs. $\pm 700\Omega$.
20,000 and 1,000 Ohms per Volt D.C., 1,000 Ohms per Volt A.C.

Series 858 MULTI-MASTER features a "PRECISION" designed, positive action Push-Button Range and Function selection system, affording the ultimate in operational efficiency.

Designed for reliable measurements in modern TV, F.M., A.M. and other critical electronic circuits where only minute current drain of the measuring instrument can be tolerated.

The dual-range sensitivity feature provides the equivalent of another instrument at standard 1000 ohms per volt sensitivity, in conformance with many point to point voltage readings listed by receiver service manuals.

When employed in conjunction with the Series TV-2 super-high voltage safety test probe (described below), direct reading facilities to 30,000 volts are provided. 60,000 volt multiplier is also available.

SPECIFICATIONS

★ **858-P** (Illustrated) in hardwood, portable case, with tool compartment. Size 9"x10"x4 1/2". Complete with chamber batteries and high voltage test leads. Code: Judge.

★ **858-L** in modern bakelite case with plastic carrying handle. Size 7 1/2" x 8 1/2" x 3". Complete with chamber batteries and high voltage test leads. Code: Jetty.

- ★ **EIGHT D.C. VOLTAGE RANGES**
both 20,000 and 1000 ohms per volt.
0-3-6-12-60-300-600-1200-6000 volts.
- ★ **EIGHT A.C. and OUTPUT VOLTAGE RANGES** at 1000 ohms per volt.
0-3-6-12-60-300-600-1200-6000 volts.
- ★ **EIGHT D.C. CURRENT RANGES:**
0-60-120 microamperes. 0-1-2-12 amps.
- ★ **SIX RESISTANCE RANGES**
self-contained to 60 megohms.
0-6000-60,000-600,000 ohms.
0-6-60-600 megohms.

- ★ **EIGHT DB RANGES:** -20 to +70DB, 600 ohm, 1 mw., zero DB reference level.
- ★ Two Pin Jacks for all standard ranges.
- ★ 4 1/2" 50 microampere meter, $\pm 2\%$ accuracy. Rugged, double-jewelled D'Arsonval construction.
- ★ Safety Jacks for 6000 volt ranges.
- ★ HIGHEST GRADE MATERIALS and plastic insulated wiring employed.
- ★ **ETCHED GRADE MATERIALS** and gauge aluminum panels: resistant to moisture and wear.



Series TV Super High Voltage SAFETY TEST PROBES*

Voltage Ranges to 60,000 Volts D.C.
With standard V.T.V.M.
or high sensitivity V-O-M

* U. S. Patent No. Des. 163613

"PRECISION" engineering solves the high voltage test problem with utmost safety to the operator. Series TV has been custom designed and patent protected for YOUR safety FIRST. Cartridge style high voltage tubular multiplier permits use of a single "TV" probe with many high sensitivity test sets and V.T.V.M.'s. Full details on reverse side of "PRECISION" catalog price sheet.

IMPORTANT FEATURES

- ★ Custom Molded Polystyrene Head, heavy duty bakelite handle and high-tensile barrier, specially machined internal lucite components, all spell out "HIGH VOLTAGE ENGINEERED."
- ★ High Dielectric Anti-Leakage Paths and wide, multi-channelled guard-barrier ridges spell "HIGH VOLTAGE ENGINEERED."
- ★ Internal and External Protective Grounding — Full handle length grounded internal flash-over-shield. External, grounded arc-back barrier. HIGH VOLTAGE ENGINEERED!
- ★ Heavy Duty, Grounded-Shielded Connecting Cable.
- ★ Ceramic, Helical Film-Type, Cartridge Multiplier manufactured specifically for VERY HIGH VOLTAGE APPLICATION. Removed and changed quickly, conveniently and without tools!
- ★ Positive Grounds and High Voltage Connections through high compression contact springs.

SERIES TVP—Test Probe less multiplier cartridge, with .060" pin plating terminations. Code: Ebony.

SERIES TVP-A—Similar to TVP above, except terminates in standard screw-on connector for use with most VTVM's. (Less multiplier cartridge). Code: Early.

SERIES TV2—With 30 KV cartridge for "Precision" (or any) 20,000 ohms per volt test set with 5000 V. range. Code: Every.

SERIES TV-4—With cartridge for ranges to 60 KV for use with "Precision" EV-10A and EV-20. Code: Excel.

SERIES TV-4A—Same as TV4 above, except with special adapter for Model EV-10, not EV-10A. Code: Exact.

VTVM—Cartridge Multiplier only for Series TV. See reverse side of "Precision" catalog price sheet for complete listings.

Series 866 De Luxe *Multi-Master*

Panel-Mounted A.C.-D.C. Test Set,
with 9" Meter and Remote-Control Selector Unit
5000 and 1000 Ohms per V., D.C., 1000 Ohms per V., A.C.



A LABORATORY TYPE HIGH VISIBILITY TEST SET
INDISPENSABLE TO THE WELL EQUIPPED, MODERN
TEST LABORATORY AND ELECTRONICS CLASSROOM.

The 9" meter and remote-control selector unit afford unparalleled operational efficiency with maximum physical meter protection via panel mounting above the work level.

RANGE SPECIFICATIONS similar to Series 858 above.

5000 and 1000 ohms per volt D.C. 1000 ohms per volt A.C.
54 Ranges to:

6000V., 300 Microamps, 12 Amps., 200 Megs., $\pm 70\Omega$.

★ **866** (Illustrated) in standard panel mount, size 18"x12 1/4" with dust cover. Complete with high voltage test leads and chamber batteries. Code: Novel.



-PRECISION-TEST EQUIPMENT

STANDARD OF ACCURACY

All prices are subject to change without notice



- ★ **612-C** (Illustrated) In modern, chrome-trimmed, counter cabinet. Black ripple finish. Size 16" x 13 1/2" x 7", sloping to 3" at front. Code: Bison.
- ★ **612-P** In hardwood, portable case (as illustrated for 654, below). Size 12" x 13" x 6". Code: Begin.
- ★ **612-MCP** Open style, Metal Case Portable. Size 10 1/2" x 12" x 6". Code: Brine.
- ★ **612-PM** In standard size panel mount 12 1/4" x 19" with dust cover. Code: Blaze.

Series 612 CATHODE CONDUCTANCE TUBE TESTER

A Modern, Free Point, Lever-Operated
TUBE and BATTERY TESTER

The very popular "600" Series brings to modern electronic tube checking the **highest practical order of obsolescence insurance with utmost simplicity of operation, AT MODERATE COST.** This has been achieved with full conformity to the well-known "Precision" standards of quality, workmanship, and performance.

The "600" tube testing parameters are based upon the well-established, time-proven emission testing principles as have been recommended by both tube manufacturers and R.T.M.A. The "600" line affords advanced design features and performance which render it incomparable amongst instruments in its category and price range.

TUBE AND BATTERY TESTING FEATURES

- ★ TESTS ALL MODERN TUBE TYPES including 7 pin Accorns, Naval 9 pin, dual copped H.F. tubes, P.M. and TV. amplifiers.
- ★ FILAMENT VOLTAGES 1/4 to 117 volts.
- ★ ABSOLUTE FREE-POINT 10 element lever selection for merit and short tests.
- ★ DUAL SHORT-CHECK SENSITIVITY.
- ★ INDIVIDUAL TESTS OF MULTI-SECTION TUBES including tuning indicators.
- ★ BALLAST UNIT TESTS.
- ★ MICRO-LINE ADJUSTMENT
- ★ 4 1/2" METER, 2% ACCURACY.
- ★ NOISE and CONDENSER TEST pin jacks.
- ★ Pilot Light Test Socket.
- ★ DYNAMIC "UNDER-LOAD" TEST for all popular radio A, B, and C dry batteries.
- ★ Built-in, brass geared hi-speed roll chart.
- ★ Anodized, deep-etched, heavy gauge aluminum panel, resistant to wear.
- ★ Panel-mounted Fuse Extractor Post.
- ★ Telephone type cabled, plastic-insulated, moisture resistant hook-up wires.
- ★ Each instrument individually calibrated and sealed.



The Series 654 is available in the same four model types as described for the Series 612 above.

Model	Code
654-P (Illustrated)	Hardy
654-MCP	Hurry
654-C	House
654-PM	Heart

Series 654 COMBINATION TUBE, BATTERY & SET TESTER

20,000 OHMS PER VOLT D.C. 1,000 OHMS PER VOLT A.C.
Ranges to 6,000 V., 120 Microamperes, 12 Amps., 60 Megs., + 70 DB.

- ★ SERIES 654 is an economical, compact, **High Sensitivity Service Laboratory** designed to meet the specific needs of modern electronics service, installation and maintenance, A.M., F.M., and T.V.

Series 654 incorporates the identical tube and battery testing features as described for the Series 612 above. **PLUS** a complete wide range, high sensitivity, A.C. - D.C. circuit tester.

CIRCUIT TESTING FEATURES

- ★ 5 D.C. Voltage Ranges: 20,000 ohms per volt.
- ★ 5 A.C. and Output Voltage Ranges: 1000 ohms per volt. 0-12-60-300-1200-6000 volts.
- ★ Ranges to 30,000 Volts D.C. when used with Series TV-2 Super high voltage test probe. Not included with 654. See page 9.
- ★ 6 D.C. Current Ranges: 0-120 microamperes. 0-1.2-12-120 MA. 0-1.2-12 Amperes.
- ★ 3 Wide Resistance Ranges: 0-600-600,000 ohms. 0-60 Megs. Self-contained batteries.
- ★ 5 Decibel Ranges from -12 to +70 DB.
- ★ Fully Rotary Selective Ranges and Functions.
- ★ Only 2 Pin Jacks for all standard ranges.
- ★ Recessed 6,000 V. safety pin jacks.
- ★ 30 microampere, 4 1/2" Wide-Angle meter.
- ★ 1% Wirewound and film-type resistors.
- ★ All circuits isolated from power line.



Series 614 DE LUXE TUBE & BATTERY MERCHANDISER

Counter Display Type Tube and Battery Tester
with Large 7" Chrome Trimmed Meter.

The Series 614 has been designed for the progressive tube and battery department where an exceptionally attractive instrument is desired to step-up tube and battery sales with minimum investment.

The extra-large, offset mounted 7" meter provides a full view of test results easily visible to both customer and operator.

The tube and battery testing circuit of Series 614 is electrically identical to that described for the Series 612 at top of this page.

- ★ **614 Tube and Battery Merchandiser** (Illustrated)—In modern, chrome-trimmed, fine black ripple finished cabinet. Offset mounted meter. Cabinet size 18" x 13 1/2" x 7", slopes to 3". Code: Early.

This equipment is Approved (and/or Tested) by the CSA Approval Laboratories.



-PRECISION-TEST EQUIPMENT

STANDARD OF ACCURACY



- Series 40 (illustrated) In molded bakelite case with plastic handle. $3\frac{1}{2} \times 6\frac{1}{2} \times 2\frac{1}{2}$ ". Complete with ohmmeter batteries and test leads. Code: Visi.

Series 40 Compact Wide Range A.C.-D.C. Circuit Tester

31 Self-Contained Ranges to 6000 Volts, 600 MA, +70DB, 5 Megohms
with Full Size, easy reading 3" Rectangular Meter
1000 Ohms per Volt A.C. and D.C.

In molded bakelite carrying case, Series 40 meets the need for a compact, yet rugged test set to withstand hard usage as is imposed by the service technician, maintenance engineer, production inspector, trouble-shooter, etc.

The Series 40 offers every advanced design feature and full-bodied components as are regularly incorporated in "Precision's" larger multi-range test sets, including: Rotary Range Selection—1% shunts and multipliers—heavy duty insulated pin jacks—Large numeralled, easy reading meter. ALL RANGES, including 6000 volts and 5 Megohms, are SELF-CONTAINED NO EXTERNAL BATTERIES OR MULTIPLIERS ARE REQUIRED.

RANGE SPECIFICATIONS

- 6 A.C.-D.C. AND OUTPUT VOLTAGE RANGES at 1000 ohms per volt, 0-3-12-60-300-1200-6000 volts.
- 4 D.C. CURRENT RANGES: 0-5-6-60-600 MA.
- 2 RESISTANCE RANGES: 0-3000-500,000 ohms, 0-5 mega.
- 6 DECIBEL RANGES —25 to +70 DB.
- FULL SIZE 3" RECTANGULAR METER: 600 microamperes $\pm 2\%$ accuracy.
- 1% WIRE & FILM-TYPE RESISTORS.
- ONLY 2 PIN JACKS serve all standard ranges and functions.
- Recessed 6000 volt safety jack.
- Anodized, etched aluminum panel: resistant to moisture and wear.

LC-2 LEATHER INSTRUMENT CASE: Genuine top-grain heavy cowhide case, custom designed for the Series 40. Richly finished in dark brown. Code: Young.

Series 85 High Sensitivity Test Set

20,000 Ohms per Volt D.C. 1,000 Ohms per Volt A.C.
34 Self-Contained Ranges to 6000 Volts,
120 Microamperes, 12 Amperes, +70DB, 60 Megohms.

The Series 85 is a bakelite cased, laboratory styled, portable instrument.

Combining high sensitivity with small overall size, Series 85 is "Application Engineered" for production, lab., school and service-maintenance phases of modern electronics: A.M., F.M., and TV.

When used with the Series TV-3 super-high voltage test probe, D.C. voltage ranges up to 30,000 volts are provided for Television and similar high potential, low current circuits. See page 9.

SPECIFICATIONS

- 6 D.C. Voltage Ranges: 20,000 ohms per volt.
- 6 A.C.-Output Voltage Ranges: 1000 ohms per volt, 0-3-12-60-300-1200-6000 volts.
- 6 D.C. Current Ranges: 0-120 microamps, 0-1-2-12-120 MA and 0-1-2-12 amps.
- 4 Resistance Ranges: Self-contained batteries, 0-6000-600,000 ohms; 0-5-50 mega.
- 6 Decibel Ranges: —25 to +70DB.
- $4\frac{1}{2}$ " Rectangular Meter, 50 Microamperes, 2% accuracy.
- 1% Wire & Film-type Resistors.
- Rotary Range Selection: All standard functions at only 2 tip jacks.
- Recessed 6000 volt safety jacks.
- Anodized, heavy gauge, etched aluminum panel: resistant to moisture and wear.
- Series 85 (illustrated) In molded bakelite carrying case with plastic handle. $5\frac{1}{2} \times 7\frac{1}{2} \times 3$ ". Complete with ohmmeter batteries and test leads. Code: Walt.



Series 85



Series 80

The Series 80, laboratory styled, rotary selective, multi-range circuit tester has been designed to meet the same high calibre performance standards as the Series 85 (at left) but is specifically intended for use wherein greater resistance to electrical and physical overload is of more importance than extremely high sensitivity.

"Application Engineered" for general purpose industrial and radio service-maintenance-test requirements.

SPECIFICATIONS

- 6 A.C.-D.C.-Output Voltage Ranges: 1000 ohms per volt, 0-3-12-60-300-1200-6000 volts.
- 6 D.C. Current Ranges: 0-5-6-60-300 MA and 0-1-2-12 amps.
- 4 Resistance Ranges: Self-contained batteries, 0-1000-100,000 ohms, 0-1-10 megohms.
- 6 Decibel Ranges: —25 to +70DB.
- $4\frac{1}{2}$ " Rectangular Meter, 600 microamperes, 2% accuracy.
- 1% Wire and Film-type Resistors.
- Rotary Range Selection: All standard functions at only 2 tip jacks.
- Recessed 6000 volt safety jack.
- Anodized, heavy gauge, etched aluminum panel: resistant to moisture and wear.
- Series 80 (illustrated) In molded bakelite carrying case with plastic handle. $5\frac{1}{2} \times 7\frac{1}{2} \times 3$ ". Complete with ohmmeter batteries and test leads. Code: Weave.



Series LC-1

LC-1 LEATHER INSTRUMENT CASE

Custom designed for the Series 80 and 85. Includes a tool and test lead compartment.

Genuine-top-grain heavy cowhide with water-proof lined inside. Adjustable hand or shoulder strap. Positive snap-lock. Richly finished in dark brown. Code: Yeann.

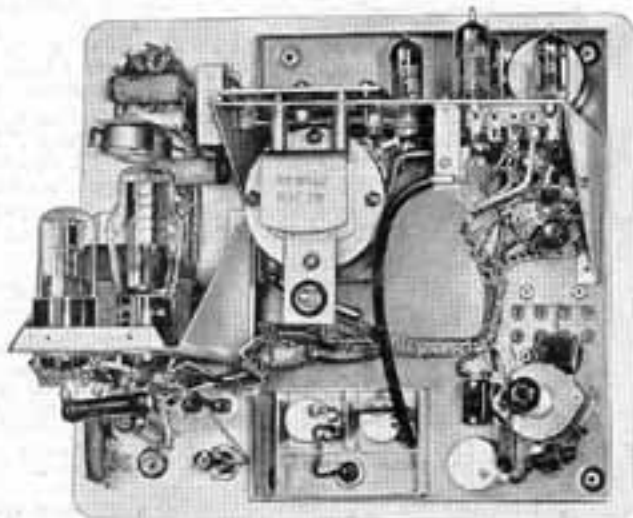
All prices are subject to change without notice

Telephone Cabling
Uniform wiring and color coding maintained by exclusive use of plastic insulated, moisture resistant telephone-type cabling.

Assembly
PRECISION Test Instruments make use of only highest quality components, carefully assembled and inspected by highly trained personnel, to insure lasting trouble-free performance.

Bobbin Winding
Current shunts, ohmmeter and special calibrating bobbins are hand wound to closer than 1% accuracy against finest laboratory bridges.

Wiring-Soldering
ONLY well trained, selected men can meet the high **PRECISION** standards of wiring, soldering and quality workmanship.



The Inside Story...

There is **NOTHING ARBITRARY, NO GUESSWORK**, behind the design, materials and workmanship which disclose **"THE INSIDE STORY"** of Precision-built instruments. Examine the underside of the panel—take note of these illustrated features which are only a few of the many points revealing the infinite and painstaking care given to

"PRECISION INDIVIDUALIZED PRODUCTION"

PRECISION TEST EQUIPMENT IS GUARANTEED FOR ONE FULL YEAR

against any mechanical or electrical defects! *Registration-Guarantee card accompanies every instrument.*

AUTHORIZED SALES REPRESENTATIVES

OFFICE	STATE	CITY-ADDRESS
C. R. Strassner Co.	California	1865 N. Western Ave., Los Angeles 27
A. J. Nelson Co.	Colorado	P. O. Box 2244, Denver 1
R. H. Van Dusen	Florida	540 Lake Elbert Drive, Winter Haven
Clark Adair	Georgia	1426 High Pt. Place, N.E., Atlanta 6
Lund-Hansen Co.	Illinois	1900 W. Montrose Ave., Chicago 13
Joseph J. Clancy	Indiana	P. O. Box 267, Wilder Road, Angola
Keenig Sales	Kansas	6359 Antioch Ave., Merriam
G. W. Detzeli	Louisiana	643 Gemini Creek Dr., Dallas, Texas
		(MAIL ADDRESS)
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P. W. Mack	Massachusetts	East Street, Granby
B. J. Filzner Co.	Michigan	8803 Michigan Ave., Detroit 10

OFFICE	STATE	CITY-ADDRESS
Kaelber & Mack	New York (City)	1270 Broadway, New York 1
Wolfe-Marney Sales Co.	New York	74 Park Avenue, Rochester 7
Edwards-Lehn & Co.	Ohio	2123 E. 9th St., Cleveland 15
Frank Van Gilder	Pennsylvania	230 Mill Road, Havertown
P. A. Boyd	Pennsylvania	409 Todd St., Pittsburgh 21
Wm. T. Little	Tennessee	P. O. Box 308, 704 Lumpkin, East Point, Georgia
		(MAIL ADDRESS)
G. G. Willison	Texas	1821 W. Alabama, Houston 9
August J. Nelson	Virginia	1038 N. Ingleside Ave., Catonsville 26, Maryland
		(MAIL ADDRESS)
Northwestern Agencies, Inc.	Washington	4130 First Ave. S., Seattle 4

EXPORT DIVISION

Merhan Exporting Corp.
458 Broadway, New York 13, New York



CANADA
Atlas Radio Corporation
560 King Street W., Toronto 28, Ontario

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PRECISION APPARATUS COMPANY INC., ELMHURST, L. I., NEW YORK
Manufacturers of Fine Electronic Test Instruments for Over 20 Years

PRECISION APPARATUS COMPANY, INC.

92-27 HORACE HARDING BOULEVARD • ELMHURST, L. I., N. Y.

PRICE BULLETIN

Effective June 16, 1953

(Supersedes all previous price bulletins)

MODEL	DESCRIPTION	Shipping Weight	Net Price
J-L	Multi-range A.C. Ammeter — Open Lab. Portable	7 lbs.	\$27.75
J-P	Multi-range A.C. Ammeter — Closed Portable	8 lbs.	29.75
LC-1	Leather Carrying Case for Models 80 and 85	3 lbs.	9.50
LC-2	Leather Carrying Case for Model 40	2 lbs.	5.75
TVP	High Voltage Television Probe LESS multiplier cartridge	2 lbs.	12.25
TVP-A	Similar to TVP (above) except terminates in Amphenol MC-IF (or equal) screw-on type connector LESS multiplier cartridge	2 lbs.	12.35
TV-2	Model TVP WITH 30KV cartridge for Precision 20,000 ohms/volt test-sets	2 lbs.	14.75
TV-4	Model TVP-A WITH X100 cartridge for Series EV-10A and EV-20 VTVM's	2 lbs.	14.75
TV-4A	Same as TV-4 except furnished with special pin jack adapter for use with Precision EV-10, NOT EV-10A.	2 lbs.	14.75
TVM	Multiplier cartridges for TVP and TVP-A. See reverse side for list of instrument models versus resistance values and price schedule	8 oz.	—
SP-5	Oscilloscope Test Probe Set	3 lbs.	23.50
EV-10A-MCP	Multi-range VTVM — 7" meter — Open Portable	17 lbs.	99.75
EV-10A-P	Same as above. — Closed Portable	18 lbs.	102.50
EV-10A-PM	Same as above. — Panel Mount	20 lbs.	105.25
RF-10A	High Frequency Vacuum Tube Probe for Series EV-10, EV-10A and EV-20	2 lbs.	14.40
EV-20	Compact, portable, Multi-range VTVM—4½" meter	11 lbs.	69.75
CR-30	Cathode Ray Tube Tester	22 lbs.	104.75
40	Compact 1000 ohms/volt AC-DC Multi-range Test Set	3 lbs.	26.95
80	Lab. style 1000 ohms/volt AC-DC Multi-range Test Set	5 lbs.	34.95
85	Lab. style 20,000 ohms/volt AC-DC Multi-range Test Set	5 lbs.	39.95
E-200C	Signal Generator — Open Portable	17 lbs.	78.50
E-200C-PM	Signal Generator — Panel Mount	20 lbs.	84.00
E-400	Sweep Signal Generator — Open Portable	24 lbs.	139.75
E-400-PM	Sweep Signal Generator — Panel Mount	25 lbs.	145.25
ES-500A	5" Cathode Ray Oscillograph	44 lbs.	173.70
612MCP	Cathode Conductance Tube and Battery Tester — Open Portable	17 lbs.	76.75
612P	Same as above. — Closed Portable	19 lbs.	79.50
612PM	Same as above. — Panel Mount	20 lbs.	82.25
612C	Same as above. — Counter Case	23 lbs.	82.25
614	De-Luxe Cathode Conductance Tube and Battery Tester — 7" meter — Counter Case	27 lbs.	109.00
654MCP	Combination Cathode Conductance Tube and Circuit Tester — (20,000 ohms/volt) Open Portable	19 lbs.	107.00
654P	Same as above. — Closed Portable	20 lbs.	109.75
654PM	Same as above. — Panel Mount	20 lbs.	112.50
654C	Same as above. — Counter Case	23 lbs.	112.50
847L	"Multi-Master" 5000 ohms/volt AC-DC Multi-range Test Set — Open lab. portable	7 lbs.	51.25
847P	Same as above. — Closed Portable	8 lbs.	54.50
847-J	Industrial Circuit Tester — 847 plus A.C. Ampere ranges — Closed Portable	15 lbs.	84.25
858L	"Multi-Master" 20,000 ohms/volt AC-DC Multi-range Test Set — Open lab. portable	7 lbs.	58.75
858P	Same as above. — Closed Portable	8 lbs.	61.50
858-J	Industrial Circuit Tester — 858 plus A.C. Ampere ranges — Closed Portable	15 lbs.	91.25
866	De-Luxe "Multi-Master" — 9" meter — 5000 ohms/volt — Panel Mount	20 lbs.	85.00
10-12P	"Electronic" Tube and Battery Tester — Closed Portable	23 lbs.	107.50
10-12PM	Same as above. — Panel Mount	33 lbs.	112.25
10-12C	Same as above. — Counter Case	32 lbs.	112.25
10-15	De-Luxe "Electronic" Tube and Battery Tester — 9" meter — Upright Counter Case	45 lbs.	149.50
10-54P	Combination "Electronic" Tube and Circuit Tester — (20,000 ohms/volt). Closed Portable	25 lbs.	139.50
10-54PM	Same as above. — Panel Mount	35 lbs.	144.25
10-54C	Same as above. — Counter Case	34 lbs.	144.25
SSS Book	"Servicing by Signal Substitution"	8 oz.	.40

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